

## WHAT IS CLAIMED:

1. A composition comprising a loose mass of comminuted raw cotton linter fibers that
  - 5 a) has a bulk density of at least 8 g/100 ml and
  - b) at least 50 wt% of the fibers in the loose mass passes through a US standard sieve size #10 (2 mm opening).
- 10 2. The composition of claim 1 wherein the fibers in the mass have surfaces that are substantially free of fibrils.
3. The composition of claim 1 wherein the loose mass contains no more than 10 wt % moisture.
- 15 4. The composition of claim 1 wherein the loose mass contains no more than 20 wt % moisture.
5. The composition of claim 1, wherein the loose mass has a bulk density of at least 12 g/100 ml.
- 20 6. The composition of claim 1, wherein the loose mass has a bulk density of at least 20 g/100 ml.
7. The composition of claim 1, wherein the bulk density of the loose mass has an upper limit of 75 g/100 ml.
- 25 8. The composition of claim 1, wherein the bulk density of the loose mass has an upper limit of 60 g/100 ml.
9. The composition of claim 1, wherein the bulk density of the loose mass has an upper limit of 50 g/100 ml.
- 30 10. The composition of claim 1, wherein at least 50 % of the fibers in the loose mass pass through a US standard sieve size #18 (1 mm opening).

11. The composition of claim 1, wherein at least 50 % of the fibers in the loose mass pass through a US standard sieve #35 (0.5 mm opening).

5 12. The composition of claim 1, wherein at least 50 % of the fibers in the loose mass pass through a US standard sieve #60 (0.25 mm opening).

10 13. The composition of claim 1, wherein the intrinsic viscosity of the fibers in the loose mass has not been reduced by more than 20 % relative to that of the non-comminuted raw cotton linters.

14. The composition of claim 1, wherein the intrinsic viscosity of the fibers in the loose mass has not been reduced by more than 10 % relative to that of the non-comminuted raw cotton linters.

15 15. The composition of claim 1, wherein the cellulose present in the fibers in the loose mass has an intrinsic viscosity with a lower limit of about 15 dl/g.

20 16. The composition of claim 1, wherein the cellulose present in the fibers in the loose mass has an intrinsic viscosity with a lower limit of about 20 dl/g.

25 17. The composition of claim 1, wherein the cellulose present in the fibers in the loose mass has an intrinsic viscosity with an upper limit of about 40 dl/g.

30 18. The composition of claim 1 wherein the composition has a cellulose content of at least 60 wt %.

19. The composition of claim 1 wherein the composition has a cellulose content of at least 70 wt %.

20. The composition of claim 1 wherein the composition has a cellulose content of at least 75 wt %.

21. The composition of claim 1 wherein the composition has an upper  
5 limit of the cellulose content of 95 wt %.

22. The composition of claim 1 wherein the composition has an upper limit of the cellulose content of 90 wt %.

10 23. A process for making the composition of claim 1 comprising  
a) obtaining a loose mass of first cut, second cut, third cut, or mill runs raw cotton linters or mixtures thereof and  
b) comminuting the loose mass of raw cotton linters to a size wherein at least 50 % pass through a US standard sieve size  
15 #10 (2 mm opening).

24. The process of claim 23 wherein the loose mass contains no more than 10 wt % moisture.

20 25. The process of claim 23 wherein the loose mass contains no more than 20 wt % moisture.

26. The process of claim 23, wherein the comminuting is carried out in a comminuting apparatus selected from the group consisting of rotary mills,  
25 hammer mills, ball mills, jet mills, bowl mills, and vibration mills.

27. The process of claim 23, wherein the comminuting is carried out under an inert atmosphere in order to prevent oxidative degradation to prevent molecular weight loss of the cellulose.

30 28. The process of claim 23, wherein the loose mass is first cut raw cotton linters.

29. The process of claim 23, wherein the loose mass is second cut raw cotton linters.

30. The process of claim 23, wherein the loose mass is third cut raw cotton linters.

31. The process of claim 23, wherein the loose mass is mill run raw cotton linters.

32. The process of claim 23, wherein the loose mass also includes mechanically cleaned raw cotton linters and/or purified cellulose.

33. The process of claim 23 wherein the loose mass in the composition has a cellulose content of at least 60 wt %.

34. The process of claim 23 wherein the loose mass in the composition has a cellulose content of at least 75 wt %.

35. The process of claim 23 wherein the loose mass in the composition has a cellulose content of at least 85 wt %.

36. The process of claim 23 wherein the loose mass in the composition has an upper limit of the cellulose content of 90 wt %.

37. The process of claim 23 wherein the loose mass in the composition has an upper limit of the cellulose content of 95 wt %.

38. The process of claim 23 wherein the comminuting is performed in an apparatus that is cooled.

39. The process of claim 37 wherein the cooling is performed using a liquid coolant.

40. The process of claim 39 wherein the liquid coolant is liquid nitrogen.

5 41. A process for making an ether derivative comprising  
a) mixing the composition of claim 1 as the starting material with a base to form an activated cellulose mixture and,  
b) reacting the activated cellulose mixture with at least one etherifying agent to form a cellulose ether derivative,  
10 wherein mixing power of the activated cellulose mixture is 5 % lower than the mixing power of the same process using comparably comminuted purified celluloses.

42. The process of claim 41, wherein the mixing power of the activated cellulose mixture is 10 % lower than the mixing power of the same process using  
15 comparably comminuted purified celluloses.

43. The process of claim 41, wherein the mixing power of the activated cellulose mixture is 15 % lower than the mixing power of the same process using comparably comminuted purified celluloses.

20 44. The process of claim 41, wherein the starting material is first treated with the etherifying agent and then treated with a base to form the cellulose ether derivative.

25 45. The process of claim 41, wherein the starting material is treated imultaneously with an etherifying agent and a base to form the cellulose ether derivative.

30 46. The process of claim 41, wherein the base is selected from the group consisting of sodium hydroxide, potassium hydroxide, calcium hydroxide, barium hydroxide, ammonium hydroxide, lithium hydroxide, strong organic bases and mixtures thereof.

47. Process of claim 41 wherein the base is selected from the group consisting of amines, quaternary ammonium hydroxides, and mixtures thereof.

48. The process of claim 41, wherein the etherifying agent is selected from the group consisting of alkyl halides, alkenyl halides, alkylene oxides, glycidyl ethers, metal salts of alpha-halogenoalkanoates, vinyl sulfonates, and mixtures thereof.

49. The process of claim 41, wherein the etherifying agent is selected from the group consisting of methyl chloride, ethyl chloride, ethylene oxide, propylene oxide, butylene oxide, monochloroacetic acid and salts thereof, butyl glycidyl ether, and glycidyl silane.

50. The process of claim 41, wherein the etherifying agent is either (3-glycidoxypropyl)trimethoxysilane, (3-glycidoxypropyl)methyldiethoxysilane or (3-glycidoxypropyl) methyldimethoxysilane.

51. The process of claim 41, wherein the ether derivative product is selected from the group consisting of carboxymethylcellulose (CMC), hydrophobically modified carboxymethylcellulose (HMC MC), methylcellulose (MC), ethylcellulose (EC), hydroxyethylcellulose (HEC), carboxymethylhydroxyethylcellulose (CMHEC), carboxymethyl hydrophobically modified hydroxyethylcellulose (CMHMHEC), hydrophobically-modified hydroxyethylcellulose (HMHEC), methylhydroxyethylcellulose (MHEC), methylhydroxypropylcellulose (MHPC), ethylhydroxyethylcellulose (EHEC), hydrophobically-modified ethylhydroxyethylcellulose (HMEHEC), methylethylhydroxyethylcellulose (MEHEC), hydroxypropylcellulose (HPC), and hydrophobically-modified hydroxypropylcellulose (HMHPC).

52. The process of claim 41, wherein the ether derivative is cationically modified.

53. The process of claim 52 wherein the cationic reagent is glycidylpropyltrimethylammonium chloride.

54. The process of claim 53 wherein the cationic reagent comprises a hydrophobic group.

5 55. The process of claim 54, wherein the hydrophobic group of the ether derivative is an alkyl group containing from 2 to 20 carbon atoms.

56. The process of claim 41, wherein ether derivative product is further processed to increase its purity.

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57. The process of claim 56, wherein the further processing comprises extracting nonpolymeric salts from the final product through the use of liquid media in which the ether derivative is rendered substantially insoluble.

15 58. The process of claim 41, wherein the starting material or the cellulose ether derivative is further processed with a viscosity reducing agent to lower the intrinsic viscosity of the cellulose ether.

20 59. The process of claim 58, wherein the viscosity reducing agent is performed by chemical means.

60. The process of claim 58, wherein the viscosity reducing agent is performed by mechanical means.

25 61. The process of claim 58, wherein the viscosity reducing agent is performed by irradiation.

62. The process of claim 58, wherein the viscosity reducing agent is performed by enzymatic means

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63. The process of claim 41, wherein the final product contains at least 65 % of the cellulose ether derivative.

64. The process of claim 41, wherein the final product contains at least 75 % of the cellulose ether derivative.

65. The process of claim 41, wherein the final product contains at least 95 % of the cellulose ether derivative.

66. The process of claim 51, wherein the ether derivative product is carboxymethylcellulose having a degree of substitution is 0.1 to 2.5.

67. The process of claim 51, wherein the ether derivative product is HEC having a hydroxyethyl molar substitution of 0.1 to 6.

68. The process of claim 51, wherein the ether derivative product is EHEC having an ethyl degree of substitution of 0.1 to 2.

69. The process of claim 68 wherein the EHEC has a hydroxyethyl molar substitution of 0.1 to 6.

70. The process of claim 51 wherein the ether derivative product is HPC having a hydroxypropyl molar substitution of 0.1 to 5.

71. The process of claim 51, wherein the ether derivative product is HEC that is further reacted with a hydrophobic reagent to form hydrophobically modified HEC (HMHEC).

72. The process of claim 71, wherein the HMHEC contains hydrophobic groups with 2 to 30 carbon atoms.

73. The process of claim 72 wherein the hydrophobic groups are separated from the HMHEC backbone by a hydrophilic spacer group.

74. The process of claim 73 wherein the hydrophilic spacer group is a polyethylene oxide moiety.



75. The process of claim 72, wherein the hydrophobic group of the HMHEC are a linear or branched hydrocarbon chain.

5 76. The process of claim 72, wherein the hydrophobic group of the HMHEC are a moiety selected from the group consisting of an aryl moiety of 5 to 30 carbons, an arylalkyl or alkylaryl moiety of 8 to 20 carbon atoms, and a perfluoroalkyl moiety of 1 to 15 carbon atoms.

10 77. The process of claim 72, wherein the hydrophobic group of the HMHEC is a hexadecyl (C16) group or a tetradecyl (C14) group.

78. The process of claim 72, wherein the hydrophobic groups of the HMHEC are different or mixed.

15 79. The process of claim 78, wherein the hydrophobic groups of the HMHEC are mixed and have one alkyl group with 3 to 18 carbon atoms and another group with 8 to 24 carbon atoms, whereby the difference between the two groups is at least two carbons.

20 80. The process of claim 51 wherein the ether derivative product is HMEHEC wherein the hydrophobic group contains from 2 to 30 carbon atoms.

81. The process of claim 80 wherein the hydrophobic groups are separated from the HMEHEC backbone by a hydrophilic spacer group.

25 82. The process of claim 81 wherein the hydrophilic spacer group is a polyethylene oxide moiety.

83. The process of claim 80, wherein the hydrophobic groups of the HMEHEC are a linear or branched hydrocarbon chain.

30 84. The process of claim 80, wherein the hydrophobic group of the HMEHEC is a moiety selected from the group consisting of an aryl moiety of 5 to

30 carbons, an arylalkyl or alkylaryl moiety of 8 to 20 carbon atoms, and a perfluoroalkyl group of 1 to 15 carbon atoms.

85. The process of claim 80, wherein the hydrophobic group of the HMEHEC is a hexadecyl (C16) group or a tetradecyl (C14) group.

86. The process of claim 80, wherein the hydrophobic groups of the HMEHEC are different or mixed.

87. The process of claim 86, wherein the hydrophobic groups of the HMEHEC is mixed and have one alkyl group with 3 to 18 carbon atoms and another group with 8 to 24 carbon atoms, whereby the difference between the two groups are at least two carbons.

88. The process of claim 51, wherein the cellulose ether derivative is methylhydroxyethylcellulose (MHEC) that has a methyl degree of substitution of 0.1 to 2.5.

89. The process of claim 88, wherein the hydroxyethyl molar substitution (MS) of the MHEC is 0.1 to 6.

90. The process of 51, wherein the cellulose ether derivative is methylcellulose (MC) that has a DS of 0.1 to 2.5

91. The process of claim 51, wherein the cellulose ether derivative is MEHEC that has a methyl DS of 0.1 to 2.5, an ethyl DS of 0.1 to 2.5 and a hydroxyethyl MS of 0.1 to 6.0.

92. The process of claim 51, wherein the cellulose ether derivative is methylhydroxypropylcellulose (MHPC) that has a methyl degree of substitution of 0.1 to 2.5.

93. The process of claim 95 wherein the hydroxypropyl molar substitution (MS) of the MHPC is 0.1 to 6.

94. The process of claim 41 wherein the starting material is dispersed in a nonreactive organic diluent.

5            95. The process of claim 94 wherein the nonreactive organic diluent is selected from the group consisting of acetone, methanol, ethanol, isopropanol, t-butyl alcohol, and mixtures thereof.

10           96. The process of claim 95 wherein the nonreactive organic diluent contains water.